Lab Course in Plant Epigenetics

Ben-Gurion University of the Negev, French Associates Institute for Agriculture and Biotechnology of Drylands, Jacob Blaustein Institutes for Desert Research
Sede Boqer Campus, Midreshet Ben Gurion
Course Name: Lab Course in Plant Epigenetics (4 credit points)
Course No. 001-2-2040
Lecturer Name: Prof. Gideon Grafi (ggrafi@bgu.ac.il; 08-656-3479)
Semester, Year: Semester break, Feb 2026.

Course Description:
The aims of the course are to demonstrate several major techniques commonly used in epigenetics, a topical issue in biology that impacts basic science, clinical medicine and agriculture. These techniques will be used for exploration of unique epigenetic features employed by desert plants growing in their natural habitats. Epigenetic regulation refers to heritable control mechanisms of gene expression superimposed on the DNA sequence. Such mechanisms include DNA methylation and posttranslational modifications of core histone proteins that affect chromatin structure and function.
The course constitutes of 3-4 sessions of field tour (around 3-4 h each), which will take place during the fall semester, for collecting annual and perennial desert plants nearby the campus. The samples will be processed, that is, nuclei preparation and fixation and protein extraction. These materials will be used during the one-week-lab course at the semester break for the analysis of epigenetic constraints employed by desert plants in their natural habitats.

Course Objectives:
Training students in observing plants in the field and formulating biological questions related to their survival in the desert from epigenetic perspective. Providing students with the knowledge and the capabilities of using common epigenetic tools for studying genome organization and chromatin structure and function. Guiding students in visualizing and interpreting epigenetic results as well as in arranging and describing results as figures for the purpose of presentation/writing a paper.
Course requirements: Molecular biology and epigenetics (N0. 001-2-2036) or equivalent.

Grading will be based on the following:

1. Attendance
2. The quality of presenting papers.

a. This will require reading and understanding the paper to be presented in great details, as well as reading supporting papers if necessary.

b. Each student must read all papers before presentation time.

c. Participation in the discussion of the paper. Asking questions, making comments etc.

3. Discussion of the results obtained for the analysis of plants.
4. Final report in the form of a scientific paper should be submitted within 2 weeks from the end of the course.

Description of Meetings and assignments

Day 1:

Lab work

10:30 – Nuclei isolation from leaves tobacco/Arabidopsis, fixation and monitoring nuclei preparation by staining with DAPI, followed by inspection under a confocal microscope.

Briefing on confocal microscope.

-Micrococcal nuclease (MNase) assay (start).

- Extraction of total proteins from plant tissues.
- Extraction of histone proteins (start).

-DNA extraction for methylation analysis.

Day 2:

Lab work

10:30- MNase - continue up to precipitation of DNA (Optional running agarose gel).

-Fluorescence in situ hybridization (FISH) start.

- Histone extraction – continue.
- Restriction of Genomic DNA by methylation sensitive enzymes.

Day 3:

Lab work
-FISH continue and inspection under a confocal microscope
-Analysis of MNase assay.
- Immunoblotting (western blot analysis)
-In gel nuclease assay

Day 4:

-End in gel nuclease assay
-Chop PCR analysis
-Chromatin fractionation (start).
-preparation of protoplasts from Arabidopsis/tobacco leaves and transformation of protoplasts with plasmid containing GFP-tagged nuclear protein.

Day 5:

End of Chromatin fractionation (running DNA gels)
End of protoplasts transformation and inspection under a confocal microscope.

13:00-14:00 - Discussion of results and instructions for submission of lab report.